EVALUATION OF TESTIMONY

The U.S. Environmental Protection Agency (EPA) commented that the proposed revisions to the State Implementation Plan (SIP) for the Dallas/Fort Worth (D-FW) ozone nonattainment area did not include specific control strategies and that the general analysis was not sufficient to be deemed a demonstration of attainment. The Environmental Defense Fund (EDF) commented that they are disappointed that more was not done to reduce ozone levels in the D-FW area before the November 1999 attainment deadline.

The commission points out that a series of events occurred prior to the attainment deadline for the D-FW area which affected the planning process. Prior to the promulgation of the revised ozone standard in July 1997, a recommendation from the Federal Advisory Committee Act Subcommittee on Ozone, Particulate Matter, and Regional Haze Implementation (FACA) was that the EPA would not take action on future bump-ups or attainment demonstrations under the 1-hour ozone standard. The understanding was that since the new 8-hour ozone standard was more protective of human health, current nonattainment areas would begin the transition to this more restrictive standard without delay. Due to the amount of time involved in many of the planning procedures, the state had no choice but to accept EPA's position and begin taking steps to address the 8-hour standard in an expeditious manner. For example, photochemical modeling episode selection and all of the components that are set in motion from this decision, were made based on the understanding that current nonattainment areas would begin planning for the 8-hour standard. However, EPA was compelled to continue requiring that areas must comply with the 1-hour standard before addressing the new 8-hour standard. This action significantly compressed

and increased the state's planning timeframe workload for the D-FW, Houston/Galveston, and Beaumont/Port Arthur nonattainment areas.

It was determined, through the use of photochemical modeling, that the State of Texas did not significantly impact other states involved in the Ozone Transport Assessment Group (OTAG) and therefore was not included in EPA's 22-state nitrogen oxides (NO_x) SIP call. At the same time, however, the commission believed that use of regional controls would be necessary for the state to address the new more restrictive 8-hour ozone standard. This will be essential for both potential new nonattainment areas as well as existing ozone nonattainment areas in Texas. As a result, the Texas Clean Air Strategy was developed. This plan will utilize regional, common sense control strategies which would be beneficial to all of east and central Texas. This unprecedented strategy in Texas will take some time to develop.

The results of the photochemical modeling for the D-FW Attainment Demonstration show that reductions in NO_x will be more effective at reducing ground level ozone than volatile organic compounds (VOC) reductions and that a combined NO_x and VOC strategy will be the most effective. On November 13, 1998 the commission sent a letter to EPA stating that because modeling indicates that NO_x reductions will contribute to attainment for the ozone standard in the D-FW area and the conditional nature of the §182(f) NO_x waiver for D-FW, it is their understanding that EPA will initiate rulemaking to reinstate the requirements for these rules.

The commission emphasizes that there has not been enough time to adequately prepare a full attainment demonstration including the implementation of specific control strategies and rules sufficient to bring the D-FW area into attainment of the 1-hour ozone standard by November 15,

1999. Letters of correspondence were exchanged and a series of meetings were held between the commission Chairman, the EPA Regional Administrator, and local officials over the last year to specifically discuss the importance of working together in partnership to meet all of the planning requirements in such a short timeframe. As a result of these meetings and the issues at hand, the commission proposes to submit a full attainment package for the D-FW area including tested control strategies, public comment, and adopted rules approximately one year from the current attainment demonstration submittal deadline, which the commission anticipates would be in March 2000.

EPA commented that they had not received sufficient documentation on the Rate-of-Progress (ROP) plan and had not had time to review some of the documentation, in particular the modeling appendices and the revised protocol prior to composing these comments.

Subsequent documents and appendices have been added to the SIP and have been sent to EPA whose input can be addressed prior to the next revision of the attainment demonstration, which the commission anticipates submitting in March 2000.

EDF commented that the integration of local and regional controls was not fully discussed in this SIP revision and that further details should be provided about how regional controls will be integrated into the D-FW Attainment Demonstration.

The commission agrees that in order for the D-FW area to attain the 1-hour National Ambient Air Quality Standard (NAAQS) for ozone, an effective strategy consisting of both local and regional controls will be necessary. Because there was not enough time to adequately prepare a full

attainment demonstration including regional controls by the November 15, 1999 deadline, this SIP revision focuses on EPA's requirement for reasonable further progress in the four-county nonattainment area for the years 1997 through 1999. The commission proposes to submit a full attainment demonstration at a later time including tested control strategies, both local and regional, and adopted rules in order to attain the 1-hour ozone standard.

The Printing and Imaging Association of Texas (PIAT) commented that area source emissions are "grossly inflated" and that the state and EPA should "relook at the way they calculate area sources".

Both the commission and EPA recognize the need to improve the accuracy of emissions estimates used in the SIP process. To that end, several initiatives have been undertaken both at the federal level and the state level to develop better emission factors and calculation procedures. At the federal level, most notably, the Emission Inventory Improvement Program has been a combined state and EPA effort resulting in several volumes of preferred and alternative methods for estimation of emissions. One volume is devoted entirely to area source categories. Over the past several years the commission has managed several contractor projects to address improvements to area source estimation methods. Some of the improved emissions estimates have been incorporated into the SIP process. Other contractor reports are being reviewed for methods that can be incorporated into the inventory process. Participation of industrial association representatives in this ongoing inventory improvement process is always welcome.

PIAT voiced concern that area source controls would be implemented while the D-FW area is dominated by mobile source emissions. They also stated that only a small fraction of the area source emissions are made up of local businesses.

Because of the reclassification from moderate to serious, there are certain rules that are being developed concurrently along with this SIP. These rules are being covered under separate rulemaking and include the establishment of NO_x Reasonably Available Control Technology (RACT) and fix-ups to VOC RACT rules for companies affected by the change in the major source definition. No area sources or small businesses are affected by the rules associated with this SIP revision.

PIAT commented that the triggering of contingency measures that contain rules affecting small businesses would be far more costly to implement compared to the benefits that the reductions would achieve and that mobile source control strategies be considered instead.

The commission does not plan at this time to utilize any of the contingency measures contained in this SIP.

EDF commented that the future attainment date should be well in advance of the statutory deadline, preferably no later than 2003 unless the D-FW area is bumped up to the severe classification and accepts the 2005 deadline. EDF also stated that a date should be specified for when a full attainment demonstration would be submitted to EPA including the modeled control strategies and rules necessary for the D-FW area to attain the 1-hour ozone standard.

The commission has indicated to EPA the intent to submit a full attainment demonstration one year from the March 20, 1999 deadline. This future SIP will contain modeled control strategy results as well as the rules necessary to bring the D-FW area into compliance by a future year. The future attainment deadline has not been determined yet.

EDF and EPA commented that it was not clear how the 9% ROP was calculated and that additional documentation should be provided regarding how the 9% ROP target is derived and how existing control measures and NO_x RACT will achieve that target. They also stated that an explanation is needed to justify negative growth projections in light of rapid local growth.

The ROP has been recalculated and is addressed in more detail in responses that follow.

EDF commented that the impact of federal rules for small engines appears to be overstated for nonroad mobile source emissions. EDF stated that the control factors apply to individual engines, but will not apply to an entire small engine category until the entire fleet is turned over after several years. As a result, EDF stated, the actual growth in the area and nonroad mobile source categories has likely been underestimated.

In estimating VOC reductions from small utility engines, staff applied an incremental control efficiency factor reflecting an increasingly larger percentage of the equipment fleet subject to controls over time, as the result of equipment turnover. The overall control efficiency factor for the period 1990-1996 is 11.9%, and for 1990-1999, it is 14.8%. The difference between these two sets of reductions is the credit for 1996-1999 (2.37 tons per ozone day (tpod)). Thus, only that portion of creditable reductions applicable for 1996-1999, representing fleet turnover occurring during that period, has been claimed.

EPA commented that reductions for Tier I, Inspection/Maintenance (I/M), and Reformulated Gasoline (RFG) in Tables 5.3-1 and 5.3-2 appear to be already included in the estimate of growth given in

Tables 5.2-1 and 5.2-2. EPA requested that mobile source emission estimates be better documented to show that emission reductions are not being double-counted.

The values provided in the proposal were intended to be placeholders until updated numbers could be provided by the North Central Texas Council of Governments (NCTCOG). The VOC reductions from Tier I, I/M, and RFG in Table 5.2-1 and the 1999 on-road mobile emissions growth estimate have been recalculated by NCTCOG. NCTCOG's documentation is provided as a supplement to this SIP. The revised value of 247.75 tpod reflects 1999 on-road emissions, and does not include reductions previously credited.

EPA commented that the VOC on-road emissions in Table 5.2-1 do not match the state's approved 1990 emissions inventory.

The VOC on-road emissions in Tables 5.2-1 and 5.3-1 have been updated with the value of 306.60 tpod to match the approved 1990 emissions inventory. The value previously reported, 204.35 tpod, corresponds to the 1996 adjusted base year inventory.

EPA commented that both the 1996 and 1999 adjusted on-road emissions inventories are larger than the 1990 on-road inventory. EPA further commented that this should not be possible since the lower emission factors for 1996 and 1999 fleets, when applied to the 1990 Vehicle Miles Traveled figures, would result in lower, not higher, adjusted inventories.

The revised values for VOC on-road emissions in Table 5.2-1 are as follows: 306.60 tpod (1990 base year inventory), 204.35 tpod (adjusted base year relative to 1996), and 192.59 (adjusted base year relative to 1999).

EPA commented that it encouraged the use of Transportation Control Measures (TCMs) in the SIP to help achieve emissions reductions, but stated that if added to the SIP they must comply with EPA policy and must be approved by EPA.

Appendix G contains the list of TCMs and the emission reductions projected for TCMs. All of the projects in this list have been completed since 1996 or are currently under construction and will be operational by November 15, 1999. These projects have been included in a conforming Transportation Improvement Program and Metropolitan Transportation Plan. The state is aware of EPA's policy and intends to comply with it.

EPA pointed out discrepancies between the projected VOC and NO_x emissions, furnished by the D-FW International Airport, and the estimated 1999 VOC and NO_x emissions provided in the state's plan. EPA requested documentation of the state's estimates of emissions and growth for area airports be included.

The 1999 VOC and NO_x emissions have been revised, using existing data from NCTCOG and updated information from the D-FW International Airport. As shown in Appendix J for VOC and NO_x, the projected 1999 emissions have been adjusted for contributions from the D-FW International Airport. Tables 5.2-1, 5.3-1, and 5.3-2 have been revised to reflect these changes.

EPA requested a demonstration that the state's uncontrolled growth estimates for aircraft do not include credits, summarized in Table 5.3.1, taken for the conversion of commercial aircraft engines to Stage 3 standards.

The Airport Noise and Capacity Act of 1990 (ANCA) requires that Stage 2 engines in all commercial aircraft be replaced by quieter, cleaner Stage 3 engines by January 1, 2000. Although the primary purpose of the ANCA rules is to reduce noise from jet aircraft, the rules also result in a 40% overall reduction in VOC emissions. In the 15% ROP SIP for D-FW, the agency projected 1996 aircraft Stage 3 emissions at 5.40 tpod, and took credit for an incremental reduction of 0.60 tpod, or 11% of the total. The remaining 29% of these creditable reductions, or 1.56 tpod, will take place by the end of 1999. Therefore, 1.56 tpod VOC are credited in the current 9% ROP SIP.

EPA commented that federal conformity rules require the state to explicitly specify motor vehicle emission budgets (under transportation conformity), as well as similar emission budgets for such sources as airports (under general conformity). The D-FW International Airport requested that the agency consider establishing emission budgets adequate to account for anticipated airport growth beyond the year 1999. The D-FW International Airport also requested clarification that an emissions budget for construction applies to the entire nonattainment area, not just to the general source category of airports.

The commission agrees with EPA regarding the requirement to establish motor vehicle emission budgets under transportation conformity rules. These federal requirements are codified at 40 CFR 51, Subpart T; state rules to implement and enforce transportation conformity rules have

been adopted by the commission under 30 TAC §114.260, regarding Transportation Conformity. The agency routinely updates motor vehicle emission budgets whenever the SIP is revised for a given ozone nonattainment area. This SIP budget reflects emissions growth of on-road mobile sources to the appropriate milestone or attainment year, but not beyond.

However, regarding the establishment of emission budgets for such sources as airports under the general conformity rules, the commission does not agree with EPA. Federal requirements for general conformity are codified at 40 CFR 51, Subpart W; state rules to implement and enforce general conformity rules have been adopted by the commission under 30 TAC §101.30, regarding Conformity of General Federal Actions to State Implementation Plans. The commission interprets these rules to require an emissions budget only for the following emissions inventory sectors: point, area, on-road mobile, and nonroad mobile. Airports are included in the nonroad mobile sector. The commission believes that preparing more detailed emissions budgets within these sectors for specific sources (such as airports) or activities (such as construction) goes beyond the requirements of the general conformity rules. Thus, the emissions inventory figures submitted to EPA with each SIP revision, reported for the sectors listed above, become the budget for general conformity purposes. The budget for nonroad mobile sources, for example, includes the entire ozone nonattainment area, and does not pertain exclusively to airports.

EPA and EDF commented that a considerable amount of reductions were due to negative growth and that sufficient information was not available to address why emissions had decreased.

The context of the comments indicates that they are primarily directed toward the point source category. Since the proposal, the staff has developed a more detailed analysis of the point source

inventory change between 1990 and 1996, similar to that provided in the HGA SIP in May 1998. The documentation of this analysis is provided in new Appendix H of this SIP. The analysis indicates that the reduction in the point source NO_x inventory between 1990 and 1996 was a result in measurement changes, or paper. These changes are not creditable reductions. The analysis of the VOC change indicates that the reduction was primarily due to shutdowns, process changes, and control devices added; or change that was real. The analysis in Appendix H has been used to backcast 1990 and project 1999 emissions.

The NO_x inventory and survey results are supportable by external information as well. More than 90% of the D-FW point source NO_x inventory is from electric utility plants, so the utility behavior largely reflects the entire point source NO_x inventory. The utility units in D-FW are relatively old gas peaking units--33 of the 36 power boilers were built before September 1971. The other three were built in the 1970s. The units are among the most expensive electricity producers, so they run "last on/first off." The sum of the total utility boiler annual heat input for 1990 and 1996, from information in the EPA acid rain data base, and from other data for the smaller units, indicates a 5% decrease from 1990 to 1996. This shows that growth in electric supply came from outside the four county area. The Comanche Peak nuclear plant, which went on-line during this period, is an example of a large new source of supply. There have been no major new NO_x projects permitted in D-FW since the 1980 version of the Prevention of Significant Deterioration rules. This also supports the finding of little NO_x point source growth. The additional NO_x emission monitoring starting in 1995 required by the federal acid rain program accounts for the apparent reduction in NO_x in the emissions inventory from 1990 to 1996. Before the sources were monitored, there was a tendency to rely on short term test results and the EPA's utility boiler NO_x emission factor, both of which tend to overestimate annual NO_x emissions.

The reduction in the point source VOC inventory is attributable to several real factors. National defense installations and contractors experienced substantial production decreases during this period at the end of the Cold War. The addition of control equipment to comply with the rules adopted to meet the 15% VOC ROP requirements also accounts for a substantial amount of the reductions. In order to avoid double counting of reduction credits, reduction credit in line 10 of Table 5.2-1, has been eliminated. This change makes the D-FW point source VOC growth approach essentially identical to the approach used for the HGA point source NO_x in the last SIP. There, without a line item for NO_x point source rules between 1990 and 1996, the commission relied on the "real" portion of the reduction between 1990 and 1996 indicated by the emission inventory and survey results to project 1999 emissions.

EPA expressed some concern that the commission felt it was inappropriate to compare modeled to monitored concentrations of precursors in its analysis. EPA asserted that "where appropriate, the comparison of modeled predictions and monitored data of precursors should be used in evaluating the modeling."

The current ozone models are designed to forecast ozone, not to forecast precursors. Since the current ozone models are not designed to replicate precursor concentrations, the EPA guidance does not require precursor comparisons. The EPA modeling guidance for model performance evaluation only specifies procedures comparing monitored ozone to modeled ozone.

NO_x monitoring data is designed for evaluation of the nitrogen dioxide (NO_2) annual NAAQS and not necessarily for ozone evaluation. The monitors are calibrated for the NO_2 standard and not for the lower levels of NO_x typically found in urban areas in Texas. Comparisons between

monitored and modeled values of NO_x for photochemical modeling should be based on data collected from monitors that are sensitive to low levels of NO_x. Current monitoring is uncertain for levels lower than 10 parts per billion, so it is not proper to compare modeled values of NO_x or VOC/NO_x ratios to corresponding monitored values.

The consensus of the Model Evaluation subcommittee at the first Ozone/PM_{fine} Modeling Workshop was that given the current state of the science for ozone modeling, it is premature to use precursor comparisons to evaluate model performance. The subcommittee also recommended that in the future additional compounds be monitored, so that useful comparisons can be made. The commission technical staff concurs with the committee consensus. When the state-of-the-science has advanced enough to permit valid performance evaluation conclusions to be drawn from precursor comparisons, the commission will do so.

EPA expressed concern that in modeling, there is always a risk of "getting the right answer for the wrong reason".

The commission shares that concern but points out that until there are significant improvements in the state of the science, those concerns cannot be completely resolved by any finite number of tests. The commission has done all the tests suggested in EPA Guidance. Since EPA's mandated deadlines are short and inflexible, it is unrealistic to insist upon additional tests which evaluate possible combinations of compensating errors. Given the current state of the science, it may be impossible to know if any of the ozone modeling results and answers have ever been achieved for the correct reasons.

In order to meet EPA's deadlines, it is necessary to proceed when performance meets existing criteria and the technical staff is satisfied with results. Our team of experts has reviewed the D-FW modeling and is confident of the conclusions and the directional guidance that have been developed. The commission is ready to move forward, model specific control strategies, and meet the deadlines to ensure that sanctions are not applied.

The commission provides the following general responses to the general comments stated in the EPA cover letter:

The commission utilized EPA-approved and recommended approaches for development of emissions inventories utilized in the modeling as well as new procedures based on recent studies. These approaches represent the state-of-the-science at this time. Use of other untested approaches would not be appropriate without advances based on scientific data.

In many cases the commission has gone well beyond generic "cookbook" approaches to develop time-of-day, industry, and even site-specific inventories that are more accurate than the default procedures. Examples are the use of biomass measurements coupled with emissions factors from BEIS-II for determining biogenic emissions and use of continuous monitoring data for point source emissions where available.

The commission has continuously upgraded meteorology inputs, emissions procedures, and even the choice of photochemical models as the state-of-the-science has advanced. Further, the commission has funded studies to improve meteorology, biomass estimates, and emissions inventory procedures. The agency has encouraged external peer review to further the state-of-the-

science and has been a leader in that respect. The commission continues to fund studies and will incorporate improvements into photochemical modeling when they are validated, finalized, and tested.

Further, where there have been advances in the state-of-the-science, the commission has incorporated the results of those studies into the modeling when they were conclusive, unambiguous, and improve model performance. Where methodological differences of opinion exist, they are frequently the result of EPA's insistence upon comparing innovations and improvements to the older methods in BEIS 1, MOBILE5A, the Diagnostic Wind Model, and UAM-IV.

EPA commented that use of the Comprehensive Air Model with Extensions (CAMx) model cannot be justified without a larger (but unspecified) number of diagnostic and sensitivity tests. EPA further stated that due to the discrepancies between modeled and ambient isoprene concentrations and the simulated mixing height, the requirements for sufficient diagnostic and sensitivity analyses to support the use of CAMx has not been met. EPA also indicated that CAMx has not had widespread use for regulatory modeling and that the commission's application of the CAMx model to "the D-FW area should include sufficient diagnostic and sensitivity analyses to adequately evaluate and ensure that suitable model performance is being achieved for the right reasons".

The commission disagrees with this comment for the following reasons:

Many of EPA's comments in the appendix related to the CAMx issue are matters of EPA staff opinion and technical disagreement rather than fact. Most of them apply to emissions inventory

and meteorological concerns that would be applicable to *any* photochemical model. In this instance it is inappropriate to challenge the selection of the CAMx model based on emissions inventory and meteorological concerns. These problems are generic to the nature and current state-of-the-science of photochemical modeling. The same issues could have been raised regardless of whether UAM-IV, UAM-V or CAMx had been used.

The commission points out that EPA selected the CAMx model to set the NO_x budgets for the OTAG SIP Call.

The commission has previously responded to EPA's specific comments on mixing height used in CAMx showing EPA's analysis on mixing height to be incorrect.

The commission has already conducted numerous diagnostic and sensitivity tests with CAMx and includes the results of those tests in the SIP revision. The CAMx modeling for D-FW has delivered some of the finest modeling the agency has ever seen.

The commission acknowledges EPA's concerns about biogenic concentrations but asserts that sufficient sensitivity testing has been conducted to assure that the uncertainty in isoprene concentrations does not change the directional guidance. This issue is discussed later in the comments.

The commission does not understand EPA's comment about regulatory use since EPA selected the CAMx model to set the NO_x budgets for the OTAG SIP Call.

The commission has submitted the diagnostic and sensitivity analysis required in the EPA modeling guidance. Those tests indicate that the modeling meets EPA's current performance standards. The analysis meets the requirements of "Guideline for Regulatory Application of the Urban Airshed Model." The commission welcomes the development of definitive peer-reviewed procedures and specific tests to evaluate model performance and to determine with certainty if model performance is being achieved for the right reasons.

In the past year, the commission has exchanged letters and memos as well as participated in numerous telephone conferences and face-to-face meetings with EPA on these issues. The commission has also discussed these issues with the D-FW Oversight Committee (of which EPA is a member). The Oversight Committee did not make any comments on the modeling. The commission believes that further discussion with EPA staff will not resolve these issues. The commission intends to submit the D-FW SIP revision as is without including any additional model comparisons or sensitivity data. None of the comments indicate that a different model would produce better results than the D-FW CAMx work. It is important to our stakeholders that we use a model that is free, non-proprietary, and available to anyone that might want to replicate our modeling. The commission believes that further discussion of model selection is non-productive.

EPA expressed concern about a discrepancy between a previous communication and data in Table 3.7-1 of the SIP revision.

The value in Table 3.7-1 is the most current.

EPA expressed concern about the methods used to estimate the height of the mixing layer and the concentrations above and below the mixing layer on the northeastern edge of the modeling domain (Kentucky and Tennessee).

The commission believes that it is extremely unlikely that the concentrations above the mixing layer at the northeastern edge of the coarse grid modeling domain have any material effect on ozone formation in the D-FW area. The commission selected the boundaries of the modeling domain specifically so that edge conditions would have a negligible effect on D-FW ozone.

The commission believes that the procedures used to develop conditions at the northeastern boundary were adequately explained and provided to EPA in the memo dated April 21, 1998 (see appendix M). The commission does not believe that further discussion of this issue will be productive.

EPA expressed concern that some of the surface data was not used in developing the meteorological fields.

Surface wind data is affected by trees, buildings, and other urban features in the immediate vicinity of the monitor. Although monitor sites are initially selected to minimize or eliminate these effects, as the urban area grows the data from surface monitors becomes distorted by local features and less representative of the city as a whole.

This question was previously answered during the March 5, 1998 teleconference with EPA, documented in a memo dated March 9, 1998, which is included as Appendix M to the SIP.

Meteorological data from some redundant and nonrepresentative sites was not used. Determination of which stations to include was based on the analysis and judgement of professional meteorologists.

EPA expressed concerns about the number and reliability of acoustic sounders employed during the 1996 study and the fact that no data was available above 300 meters.

Data from only one sounder (Hinton Drive site) was available during the 1996 episode. Data from a second sounder (Denton site) was not operational between June 30 and July 4, 1996. The text on page 3-7 referring to the number of sounders has been revised.

Acoustic sounders use a mathematical algorithm to determine upper air winds and a statistical test to determine whether data at various levels is reliable. Computer processing determined that the data from above 300 meters did not meet the reliability criteria.

Data from the Hinton Drive acoustic sounder was used to supplement the upper air wind data from the Fort Worth rawinsonde for the July 1996 episode. All the data available during the modeled episodes was used after quality assurance review by commission staff meteorologists.

EPA expressed concern that the episodes selected for modeling were chosen to represent typical 8-hour ozone events rather than 1-hour events.

The commission based its episode selection upon the best guidance available at the time of the decision. At that time a FACA report had recommended changing from a 1-hour to an 8-hour

standard because of recent health studies. It was not anticipated that EPA would continue requiring that areas must comply with the 1-hour standard before addressing the new 8-hour standard.

Unfortunately, EPA published its draft guidance well after the commission had begun its modeling work for D-FW. The commission evaluated the two 8-hour episodes and determined that they also included 1-hour exceedances. Given the tight schedule for SIP submittal and the fact that considerable effort had already been invested, the commission elected to proceed rather than start over.

Numerous discussions with EPA staff have attempted to point out that given the extremely tight bump-up schedule to submit a revised SIP document, it was and is still unreasonable to select, process, and model new or additional episodes.

The two multi-day episodes selected represent several different meteorological conditions leading to 1-hour exceedances: weak transport, stagnation, and a convergence event. Even though the meteorology and emissions change during the episodes, the modeling for the entire period consistently results in the same directional guidance.

EPA expressed concern that the ozone episodes selected for modeling were not among the top three ranked episodes based on magnitude of monitored ozone.

The commission asserts that it is more important to pick recent, well monitored events that are representative of current design value, exceedances, emissions, and controls than to select old

episodes based primarily on high monitored ozone values that may not represent the current design value, emissions inventory, or controls. The commission acknowledges that its position is at variance with EPA guidance on this issue but points out that guidance is merely that, not a rule or a law.

The commission points out that EPA approved the use of episodes for the OTAG modeling which were not necessarily the highest ranked episodes or meteorologically representative for all of the cities involved. Nevertheless, EPA based the NO_x SIP Call upon the use of those episodes.

EPA expressed concern that the morning wind direction during July 3, 1996 episode day was not associated with a frequent 1-hour meteorological pattern.

The commission repeats its assertion that the July 3, 1996 episode day represents a convergence situation which is a recently identified meteorological type that is not included in EPA guidance, which addresses only stagnant and windy phenomena.

The July 1-4, 1996 episode was initially selected because it had multiple 8-hour exceedances and representative wind directions for the first three days of the episode. When EPA changed its guidance it was too late to select other episodes so this episode was used for 1-hour modeling. The only day during this episode that had a 1-hour exceedance was characterized by a local wind flow convergence zone (July 3, 1996). This is an example of where the wind averaging procedure in the EPA guidance is inadequate.

The commission asserts it has modeled three primary episode days.

EPA speculated that the mismatch between the number of SAIMM and CAMx layers may cause problems when the SAIMM data is interpolated to determine data for the photochemical model.

This comment is speculative rather than definitive. An explanation is provided in the April 21, 1998 memo to EPA. Interpolation between layers is the standard method to adjust for differences in the number of layers between the meteorological and photochemical models.

EPA questioned why data from the core and regional domains was integrated after it had been converted to CAMx format rather than during the previous step.

The commission does not believe that the order of operations makes a material difference in this case.

EPA commented on the difference between modeled and observed temperature data and concluded that the modeled lapse rates would not result in as much mixing as really occurred and speculated that it might make a difference in the results.

The modeled temperatures are in fact less than the actual temperatures in the lower 3000 meters of the atmosphere. However, EPA has misinterpreted the data. In figure 3.12-6a the modeled lapse rate is steeper than the observed lapse rate up through 1600 meters, which would result in more mixing rather than less. In figure 3.12-6b the lapse rates are roughly parallel through 1600 meters, so the modeled mixing should match the real mixing.

The commission technical staff has concluded, based on previous modeling, that temperature and lapse rate differences of this magnitude make no material difference in the final results for D-FW.

EPA speculated that the vertical exchange coefficients developed in the SAIMM model would appear to mix only up to 1400 meters. Since mixing should occur up to 2000 meters this might make a significant difference in model results.

EPA has selected the wrong Kv profile for its analysis. Figure 3.12-7 was included in the SIP revision simply as an example of how the SAIMM Kv's vary over time. The figure does not show the Kv's actually used in the CAMx modeling which has fewer layers which results in a slightly different Kv profile.

However, EPA's Kv analysis is incorrect regardless of the figure used. Figure 3.12-7 shows significant values for Kv at 1400 meters (the top of layer 11) between 1200 and 1700 CST. Since Kv values affect the mixing <u>between</u> layers, significant Kv's at the layer 11-12 interface indicate that mixing into the next higher layer (e.g. up to 1800 meters) would occur if that Kv profile was used in the model.

However, it is better to evaluate actual model performance than to speculate on how the model will perform. Vertical profiles of modeled ozone concentrations produced by commission staff show that the ozone is mixed up beyond 2000 meters. These profiles were not included in the SIP revision in an effort to avoid loading the submittal with unnecessary detail.

EPA questioned how the Integrated Terminal Weather System (ITWS) data from the D-FW airport was incorporated into the model.

The ITWS data was treated the same as the other upper air data. It was interpolated to grid points as part of the objective analysis, and then used to adjust the SAIMM. See Section 3.12.2, Quality Assurance.

EPA requested a copy of a document describing the work done by the NCTCOG to develop mobile source emissions and the development of speciation profiles used in the mobile source emissions inventory. A copy of the MOBILE5A inputs used to develop mobile source emissions was also requested.

The commission recently provided the information on development of the future inventory including MOBILE5a inputs. The information requested relating to development of speciation profiles is being provided to EPA.

EPA questioned whether it was appropriate to develop mobile source data for the D-FW modeling based upon mobile source data previously developed for the Houston/Galveston (H-GA) and Beaumont/Port Arthur (B-PA) modeling which may have understated mobile emissions and performed poorly in one episode.

The on-road mobile source emissions data used in the H-GA and B-PA regions of the D-FW modeling domain were based on Traffic Demand Modeling and August 19, 1993 emissions (projected to 1996, and adjusted for day-of-week effects) because these were readily available.

The mobile source emissions for this time period were nearly identical to those developed for the September 6-11 episode, which exhibited acceptable model performance.

If there is a problem with the previous H-GA mobile source emissions inventory, it may be the result of systematic errors in the EPA MOBILE model which has recognized errors and is beyond the commission's control. The commission is willing to apply any EPA "correction factor" to the H-GA mobile source inventory until MOBILE6 becomes available.

The mobile source emissions for the H-GA area were used only in the H-GA area, not in the D-FW nonattainment area so they should not play a major role in this modeling. These mobile source emissions were also used with the modeling for the H-GA SIP (September 6-11, 1993 episode) which did perform well. Therefore, the model performance for August 19, 1993 is not a reasonable indicator to use to evaluate this distant portion of the D-FW mobile source inventory.

In any case, the commission chooses to focus the emissions inventory development efforts on the D-FW area because it has the most significant influence on the D-FW modeling results and to reuse the previously generated H-GA and B-PA work which, because of distance, has less influence on the nonattainment area.

EPA requested copies of two NCTCOG documents related to the development of area and nonroad mobile sources.

The commission has provided this information in Appendix D. A copy of the NCTCOG report on area and nonroad mobile source emissions development has been provided to EPA.

EPA questioned the use of population as surrogates in developing area and nonroad emissions for counties not included in the NCTCOG analysis.

Population is a reasonable surrogate for many, if not most, categories of area and nonroad mobile source emissions. Because NCTCOG developed bottom-up emissions estimates for the major categories in the 37 counties in the Study Area (as defined on page 3-90 of the SIP) the commission staff felt that it was justifiable to base emissions for the remaining categories on population ratios. In a small number of counties, primarily south of the Study Area (but at least partially within the Study Area Grid), emissions for all categories were based on population ratios. Although it would have been possible to use ratios based on surrogates other than population in these cases, the commission felt that it could better use its limited resources in developing high-quality emissions estimates within the nonattainment and surrounding counties.

However, the commission points out that EPA is incorrect in its suggestion that water area is the best surrogate for <u>estimating</u> recreational boating emissions, because the number of boats is more closely associated with population. However, water area is a good surrogate for <u>placement</u> of those boating emissions.

EPA pointed out differences between the area and nonroad source totals for the 1996 future base (submitted in 1994) and the 1996 base case (just submitted).

The commission staff constructed the current 1996 base case using the most recent and best available emissions factors and activity data.

EPA commented that the total NO_x emissions used in the D-FW modeling vary from day to day and that the June 1995 episode emissions were different from the July 1996 episode emissions.

EPA is correct in noting that NO_x emissions within the D-FW four-county area vary significantly from day to day, chiefly because there are only a few large NO_x sources within the four counties. When viewed from a regional (aggregated) perspective, NO_x emissions exhibit much less variability. This variability in point source emissions on the local and regional scale is shown in Appendix D, as noted on page 3-118.

The actual emissions from electric generating units, measured with Continuous Emissions Monitors (CEMs), were used in the point source modeling inventory. As noted on Page 3-103 of the SIP, this data was extracted from the 1995 and 1996 EPA Acid Rain database which documents the actual day to day and year to year variances in emissions.

EPA commented that the 1996 D-FW base case four-county emissions of NO_x and VOC were smaller than the 1996 forecast emissions submitted in the previous D-FW modeling.

The commission staff constructed the point source emissions inventory using the most recent and best available emissions factors, activity data, and CEM data where available.

EPA pointed out that a reference concerning leaf biomass densities for the D-FW Study area identified in the text was not included in the reference listing at the end of the section and requested a copy of the document.

The commission has provided a copy of the source document to EPA.

EPA speculated that the temperature difference between the 1995 and 1996 episodes was insufficient to account for the difference in biogenic emissions.

EPA's crude temperature analysis is insufficient to conclude that the temperature difference inadequately explains the differences in emissions. The analysis does not take into account the diurnal variations of ambient temperature nor the spatial distribution of ambient temperature. It does not consider that counties with different tree species and biomass densities will not respond identically to temperature differences. It does not consider that counties with differing amounts of cloud cover will not respond identically to temperature differences.

Isoprene emissions do not vary linearly with ambient temperature but exponentially. Therefore, one would not expect linear behavior from the modeling, even if there were no heterogeneity in temperature, tree species distribution, and leaf biomass density.

EPA stated that they were unable to read figures 3.13-2 through 3.13-22.

The commission recently sent EPA new copies of these figures. Members of the public are encouraged to contact the commission to obtain copies.

EPA discussed the comparability problem acknowledging that it is difficult to compare monitored precursor measurements with modeled output data. Nevertheless, EPA insisted that a comparison of model predictions and monitored data for precursors should be included in the modeling.

The commission points out that the current ozone models are designed to forecast ozone, not to forecast precursors. Further, the EPA modeling guidance only specifies procedures comparing monitored to modeled ozone for performance evaluation. Since the current ozone models are not designed to replicate precursor concentrations, the EPA guidance does not require such comparisons.

The technical consensus from experts around the country based upon the current state-of-the-science indicates that it is premature to use precursor comparisons to evaluate model performance at this time.

EPA speculated that using a non-day-specific mobile source emissions file during the two model startup days might affect results and suggested performing an additional sensitivity analyses.

As noted on page 3-95, the commission staff used emissions developed for Sunday June 30, 1996 for Sunday (text erroneously lists as Saturday) June 18, 1995. Otherwise, day-specific on-road mobile source emissions were used throughout the D-FW study area. The commission staff does not believe that this minor approximation of the first of two ramp-up days in one episode warrants additional sensitivity analysis.

EPA suggested additional sensitivity analyses should be used to determine whether compensating errors might lead to good model performance for the wrong reasons.

The commission points out that until there are significant improvements in the state-of-the-science, those concerns cannot be completely resolved by any finite number of tests. At this time,

there is no test or combination of tests that can put this issue to rest. The commission has done all the tests suggested in the EPA guidance. Since EPA's mandated deadlines are short and inflexible, it is unrealistic to insist upon additional tests which evaluate possible combinations of compensating errors. Given the current state-of-the-science, it may be impossible to know if any of the ozone modeling results and answers have ever been achieved for the correct reasons.

EPA commented that the modeled isoprene concentrations in Texas are eight times greater than the monitored isoprene in Louisiana.

The commission points out that according to the consensus of leading experts in the field, it is not appropriate to compare modeled precursor concentrations with monitored values. Further, measurements of isoprene at a single point are unlikely to represent a large area, given the heterogeneity of isoprene sources and the highly reactive nature of the compound. Finally, studies performed during the Southern Oxidant Study (SOS) experiments in Atlanta during 1990 indicated that ground-level isoprene concentrations are generally not representative of the total amount of isoprene in the boundary layer, and are therefore of limited value in assessing model performance.

Further, EPA's comparison is misleading. EPA has not established that the Pride, Louisiana site is a good example of a site with high isoprene emissions because they have not specified the species composition of the vegetation nearby. Commission staff investigation of the Pride site indicates that it is <u>not</u> densely wooded; in fact the area seems to be comprised largely of farmland interspersed with wooded areas. Also, the trees immediately surrounding the site appear to be pine trees rather than oak trees. Aside from the previously mentioned issues of temperature and

leaf biomass, emissions from pine and oak forests are very different. Pines, which appear to be the dominant species near the Pride site, emit alpha- and beta-pinenes, but very little isoprene. Therefore, EPA's claim that the commission's modeled isoprene concentrations in Dallas are higher than the monitored concentrations at a site with high isoprene emissions is erroneous, because the site in question does not appear to have high isoprene emissions.

EPA suggested that since modeled isoprene concentrations are too high, a sensitivity test based on 25% reductions was not sufficient.

The estimates developed for biogenic emissions in the D-FW area are the best available using state-of-the-science estimation methodologies, the most current published emission factors, and vegetation characterizations developed from bottom-up surveys conducted under the supervision of the top scientist in the field, Alex Guenther of the National Center for Atmospheric Research. Nevertheless, the commission shares EPA's concern about the possibility of overestimation of isoprene in the area. Although not reported in the SIP, the commission has conducted additional sensitivity analyses to address this issue.

In addition to the 25% biogenic VOC reduction referred to above, the commission also ran a series of analyses with both 25% and 50% biogenic VOC reductions. These sensitivity analyses were used to assess the directional guidance (VOC vs. NO_x) of the modeling under the two isoprene assumptions. For all episode days, NO_x was the preferred control strategy with the 25% biogenic VOC reduction and was preferred in all but one day with the 50% reduction. These analyses show the modeling to be robust even with significant overprediction (up to 100%) of isoprene.

A second analysis was conducted when modeled overnight isoprene concentrations at the Hinton Drive monitor were noted to be unusually high. The cause of this modeling anomaly was traced to the early collapse of the afternoon mixing depth (as determined by the commission's meteorological experts), coupled with advection of high isoprene concentrations from oak-dominated forest south and east of the nonattainment area.

High isoprene concentrations have been observed on several occasions at the Hinton Drive monitor, so this phenomena is known to occur in the D-FW domain. It has also been observed in the SOS monitoring and modeling as well, and so appears to be qualitatively correct. The differences between the modeled and monitored isoprene values may be attributed to the sub-grid scale heterogeneity of isoprene concentrations due to its high reactivity and the heterogeneous distribution of isoprene sources. This hypothesis is consistent with the results of the 1990 SOS experiment which showed that ground-level isoprene concentrations are not representative of the total quantity of isoprene in the boundary layer.

A third sensitivity analysis (also not discussed in the SIP) was conducted to test the effect of extending the afternoon mixing two hours later in the day (called a "K_v time stretch"). This analysis showed greatly reduced overnight isoprene concentrations (although still higher than the measured concentrations), indicating that the modeled phenomenon was largely meteorology-related. However, this Kv time stretch showed very little effect on same day (and on following day) modeled peak ozone concentrations, so no attempt was made to correct the premature collapse of the afternoon mixing since it would affect the dynamics of the meteorological model.

Sensitivity tests designed to adjust the high modeled overnight isoprene concentrations did not significantly affect model performance or modeled ozone concentrations. The commission therefore believes that a 50% reduction in biogenic VOC emissions provides a sufficient test of the robustness of the modeling relative to biogenic emissions.

EPA hypothesized that the mixed layer was too shallow and suggested that a sensitivity analysis should be conducted to determine whether better mixing through a deeper layer would improve model performance.

This issue has been previously addressed in the April 21, 1998 memo and in these comments. Evaluation of model output shows that ozone is, in fact, mixed up beyond 2000 meters, roughly matching expectations and measured mixing heights.

The commission points out that the Kv data is generated as part of a dynamic meteorological model and that manipulating a single variable in this way will throw the model out of balance. Implementing this suggestion would manipulate Kv's in a way inconsistent with model formulation and not supported by the data.